"DISAPPEARANCES" OF EGGS AND LARVAE OF *HELICONIUS* BUTTERFLIES (NYMPHALIDAE: HELICONIINAE) IN NORTHEASTERN COSTA RICA[1]

Allen M. Young[2]

ABSTRACT: Disappearances of eggs and young larvae of the butterflies *Heliconius cydno* and *H. hecale* on *Passiflora vitifolia* vines were estimated on two occasions at one locality in northeastern Costa Rica. During the first sampling period (January-February, 1977) *H. hecale* was more abundant than *H. cydno* and the opposite was the case in the second sampling period (August 1977). A total of 20 immatures (both species) were sampled the first time and 47 were sampled the second time. In both sampling periods, about 70% of the immatures of each species had disappeared either as eggs or by the third instar larva, suggesting substantial mortality (predation) on immatures. The data support the prediction of Gilbert (1975) that eggs and larva of *Heliconius* experience high levels of mortality.

Although much is known about the evolutionary biology and ecology of *Heliconius* butterflies (Lepidoptera: Nymphalidae: Heliconiinae) in Central and South America (e.g., Benson et al., 1975; Gilbert, 1975), one aspect that warrants further study is the impact of predators and parasitoids on their immature stages in the wild. Gilbert (1975) predicts that the eggs and larvae of *Heliconius* species suffer severe mortality from ants, and Gilbert and Ehrlich (1973) showed that over 90% of eggs in a *H. ethilla* population in Trinidad were killed by parasitoids. Other than the latter study, there are few published data on mortality of *Heliconius* eggs and larvae. This paper summarizes some preliminary data on "disappearances" of eggs and young larvae for *H. cydno galanthus* (Bates) and *H. hecale* (Fabricius) at one locality in northeastern Costa Rica. While the data are by no means conclusive, they offer tentative, indirect support for Gilbert's prediction of high egg and larval mortality.

Methods

This research was conducted at "Finca La Tigre", a mixed primary, secondary, and cultivated region near La Virgen (220 m elev.), Heredia Province, Costa Rica during two periods, January-February and August 1977. This locality is Premontane Tropical Wet Forest life zone (Holdridge, 1967). Here, both *H. cydno* and *H. hecale* (Fig. 1) lay eggs on *Passiflora vitifolia*

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[2] Invertebrate Division, Milwaukee Public Museum, Milwaukee, Wisconsin 53233

(Passifloraceae), an abundant vine in secondary forest habitats. Searches for eggs and young larvae were made on small vines generally free of dense adjacent vegetation. In some instances, oviposition was observed while in others the eggs were discovered. While this procedure introduced a bias into sampling, bias is already large owing to small total sample size; but vines in dense growth are more difficult to census accurately. While in the wild eggs of the two species are difficult to distinguish, the larvae are readily distinguishable (Young, 1972; 1973). Once an egg or larva was discovered, the vine was

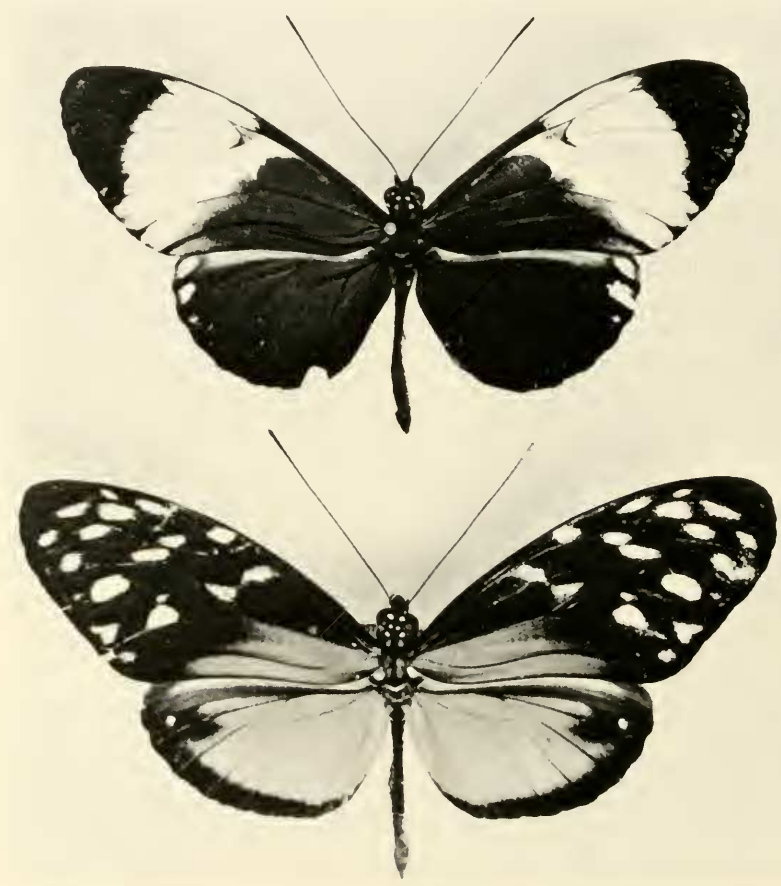

Fig. 1. *Heliconius cydno galanthus* (Bates) and *H. hecale* (Fabricius) from Finca La Tigre, La Virgen, Heredia Province, Costa Rica.

revisited to check for survival. Absence of an egg or larva was recorded as a "disappearance" and used as an indirect measure of mortality. In the August 1977 observations, less detailed records were kept, and disappearances of eggs and larvae were noted only on a single date within 10 days of the discovery of the first egg. Late third instar larvae and older ones were excluded from the data since the census intervals were long and these individuals could have reached maturity, leaving the food plant to pupate, rather than disappearing for other reasons. In rechecking eggs and larvae during February, each vine was also checked for new eggs.

Results

Twelve vines of *P. vitifolia* (Fig. 2) were censuses 16 times for *Heliconius* disappearances between January 13 and February 21, 1977. Sixteen eggs and four larvae were discovered and rechecked; of the eggs, only four (vine site A

Fig. 2. A young vine of *Passiflora vitifolia,* a larval food plant of *H. cydno* and *H. hecale* in northeastern Costa Rica.

– Table 1) were *H. cydno*. Thirty vines were censused once on August 23 following the discovery of eggs and larvae on several earlier dates (Aug. 13-17). The data for January-February are summarized in Table 1. For the August sample, thirty five eggs and 12 larvae were observed; only ten eggs and 3 larvae were *H. hecate*, the reverse of the earlier census. Eggs of *H. cydno* were sometimes found on leaf buds, and those of *H. hecale* on coiled tendrils (Fig. 3). Adjacent plants and debris did not have eggs. The vine sites were spread out over a very large area, with several hundred meters being the closest distance between two sites. An additional 10 vines examined during February did not have eggs or larvae.

For the January-February sample, of the twenty insects observed, only five (all *H. hecale*) lasted to the third instar, spending 5 to 14 days on the food plant. Most disappearances occurred before the third instar, but only seven eggs disappeared (Table 1). Thus, the disappearance rate for eggs and larvae of *H. hecale* was about 69%. For the August sample, of the 47 insects observed, only twelve (2 *H. hecale* and 10 *H. cydno*) were present on the food plants by the census date. The disappearance rate for *H. hecale* was about 77% (10/13 individuals) and for *H. cydno* it was about 70% (24/34 individuals).

In the January-February study period, on one occasion, a female of *H. cydno* deposited three eggs in quick succession (3 min.) on a food plant; of two eggs deposited on the same vine by *H. hecale*, in one case the eggs were deposited by one female, while in the second two females might have been involved (Table 1).

There were only two instances (*H. hecale*) of new eggs being discovered on a vine following the initial discovery of an egg or larvae during February, but only one of these occurred over a short interval of a few days (Feb. 3-7, Table 1).

Discussion

Assuming disappearance of an egg or larva from a vine results from a predator or parasitoid, and that my samples are sufficient, mortality of *H. hecale* and *H. cydno* on *P. vitifolia* is high. These species feed on other *Passiflora* at this locality (in prep.). Although the samples of individual species are limited, it is interesting that *H. hecale* was most abundant during the first sampling period (January-February) while *H. cydno* was found to be more abundant in August at the same locality. In addition, many more fresh adults of *H. cydno* were seen flying at Finca La Tigre in August than during the earlier sampling period.

Heliconius eggs and young larvae may be in the appropriate size range for many predatory ants attracted to *P. vitifolia*. Since some eggs or larvae disappeared quickly (within a few days), such predation may be operative. It

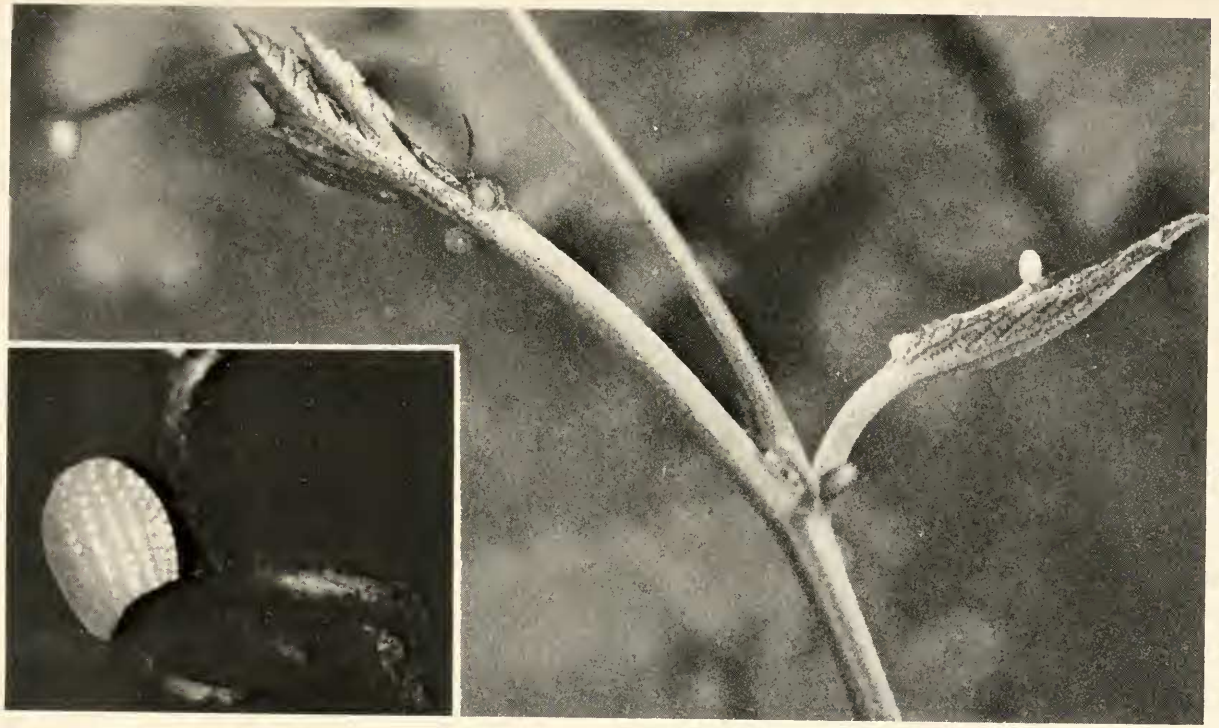

Fig. 3. Eggs (2) of *H. cydno* on young leaf and tendril (background to the left); insert: egg of *H. hecale* on mature tendril. Vine is *P. vitifolia* in both cases.

Table 1. Census history of *Heliconius* eggs and larvae in the wild, Finca La Tigre, La Virgen, Heredia Prov., Costa Rica, January-February 1977.

	Discovery Date	Vine Site	No. Eggs Per Vine	No. Larvae	Ovip. Obs?	Survival Dates and Condition					
(1)	1/13/77	A	3	0	Yes (one adult)	1/14-3 eggs	1/18-egg; 1st instar	1/19-same	1/31-gone		
(2)	1/31/77	A (same vine as #1)	1	0	No	2/2-1st instar	2/4-same	2/6-2nd instar	2/8-3rd instar	2/10-gone	
(3)	1/14/77	B	2	0	No	1/31-gone					
(4)	2/1/77	C	0	1-2nd instar (9mm)	–	2/2-same (10mm)	2/3-3rd instar (13mm)	2/6-gone			
(5)	2/3/77	D	1	0	No	2/6-same	2/7-same	2/8-same	2/14-gone		
(6)	2/7/77	D	1	0	No	2/8-same	2/14-gone				
(7)	2/14/77	C	0	1-1st instar	–	2/17-gone					
(8)	2/3/77	E	2	0	No	2/6-1 gone	2/7-both gone				
(9)	2/7/77	F	2	0	Yes (one adult)	2/8-same	2/14-one dead 1st instar; one 1st instar (6mm)	2/15-2nd instar (7mm)	2/16-2nd instar (9mm)	2/19-3rd instar (16mm)	2/20-3rd instar (21mm)
(10)	2/8/77	G	2	0	Yes (2 adults)	2/16-3rd instars 2-(15mm)	2/19-gone				
(11)	2/15/77	H	2	0	No	2/20-3rd instars (14mm)	2/21-gone				
(12)		I	0	2 (3rd instars	–	2/19-gone					

is unlikely that disappearances of larvae were due to their leaving the food plant (e.g., migration) since no major defoliation occurred and feeding took place at the terminal leaves.

The breadth of larval food plants of *H. hecale* and *H. cydno* at Finca La Tigre have not been determined, although Gilbert (1975) mentions that usually a *Heliconius* species has one local primary food plant. If *P. vitifolia* is the primary larval food plant of *H. hecale* and *H. cydno,* considerable mortality on eggs and larvae may take place. From studies on reproductive biology and longevity of *Heliconius* (Ehrlich and Gilbert, 1973; Gilbert, 1972), it is predicted (Gilbert, 1975) that larval survivorship is generally low and counterbalanced by a long reproductive life mitigated through pollen-feeding. At Finca La Tigre, both species of *Heliconius* have large white pollen loads (pers. obs.). As the spatial properties of *Heliconius* populations are determined primarily by the distribution of adult resources (Gilbert, 1975), the extent to which certain individuals of *P. vitifolia* will be used as oviposition sites depends on their locations. In the present study, the vines used were near patches of blooming cucubits (*Anguria* sp.) and these inflorescences were visited by *H. hecale* and *H. cydno* (pers. obs.). Vines consistently without eggs or larvae during the study periods were not close to blooming cucubits. The tendency for *H. hecale* and perhaps *H. cydno* to oviposit more than once on the same vine may be related to the proximity of the vine these inflorescences and the availability of other passifloraceous vines.

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